APPENDIX C

DIESEL PM RISK REDUCTION METHODOLOGY

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Note: The factors applied to account for exposure in this plan appear to be different than the factors listed in the December 2005 draft. In fact, we did not change the methodology or exposure adjustment, we are simply expressing the factors in a different way as requested by public comments. For example, the draft plan identified an adjustment factor of "0.92" for Ships-Underway that was the discount applied to ship emissions (i.e., 92 percent of ship emissions underway were discounted, leaving 8 percent remaining as the exposure adjusted emissions). In this plan, we show that 8 percent (or 0.08) explicitly as the exposure factor.

1. Derivation of Exposure Adjustment Factors

Our risk reduction analysis employs exposure factors developed from ARB staff's risk assessment performed for the Ports of Los Angeles and Long Beach, described in Appendix A. This approach recognizes that diesel PM emissions from ground level sources that typically operate within highly populated urban areas result in greater exposure per ton released than sources that emit either some distance offshore or within port facilities where a portion of the emissions are dispersed over water.

The effect is to weight the diesel PM emissions according to the exposure impact for each category of source and operational location. By using the same approach for 2001 and 2020, we can then compare the results in each year to assess the relative reduction in health risk.

Table C-1 shows the base emissions inputs and resulting health impacts (cases of premature death) taken from the Ports of Los Angeles and Long Beach risk assessment, and the calculated "tons emitted per impact." The off-port trucks and locomotives operating in the community produced the greatest health impacts per ton of emissions (or conversely, requiring the least amount of tons – 6 -- emitted per impact). We assigned an exposure factor of 1.0 (or 100 percent) to those emissions. We then normalized the exposure impact for the other categories by the off-port trucks and locomotives, dividing the tons emitted per impact for each category by 6 to derive the exposure factor. Other categories are represented by an exposure factor less than 1.0, from ships underway at 0.08 (or 8 percent), to harbor craft at 0.24 (or 24 percent), to on-port trucks and locomotives at 0.50 (or 50 percent).

Table C-1
South Coast Air Basin Diesel PM Emissions in 2002
(tons per year)

Category	Base Emissions (tons per year)	Health Impacts	Tons Emitted Per Impact	Exposure Factor*
Ships-Underway	942	12.4	76.0	0.08
Ships-Hotelling	343	20	17.2	0.35
Cargo Equipment	172	12.4	13.9	0.43
Harbor Craft	244	9.8	24.9	0.24
On-Port Trucks	41	3.5	11.7	0.51
On-Port Locomotives	18	1.5	12.0	0.50
Total	1760	60	29.3	0.20
Off-Port Trucks and Locomotives	664	111	6.0	1.00

*Product of 6.0 divided by "ton emitted per impact" for category

This tells us the relative impact of each ton of diesel PM emitted from different sources and locations. We can then apply the exposure factor to other emission estimates using the same category and location indicators to assess the relative change in health risk attributable to reducing emissions from each sector.

2. Calculation of Exposure Adjusted Diesel PM Emissions and Risk

To estimate the change in health risk from reducing diesel PM emissions from ports and goods movement, between 2001 and 2020, with full implementation of the plan strategies, we applied the exposure factor to each emissions category and location. To simplify the calculations, we combined on-port truck and on-port locomotive emissions using the same 0.50 (or 50 percent) exposure factor. We also combined transport refrigeration units with off-port trucks and locomotives to capture the maximum impact of those emissions.

Table C-2 shows diesel PM emissions by category in 2001 and in 2020 with full implementation of the plan strategies, the application of the exposure factor, and the calculation of the exposure adjusted emissions in each year.

Table C-2
Statewide Diesel PM Emissions from Ports and Goods Movement with Exposure Adjustments and Full Implementation of Plan Strategies

Category	2001 Emissions (tons per day)	Exposure Factor	2001 Exposure Adjusted Emissions	2020 Emissions (tons per day)	Exposure Factor	2020 Exposure Adjusted Emissions
Ships-Underway	5.6	0.08	0.45	5.4	0.08	0.43
Ships-Hotelling	2.2	0.35	0.77	0.3	0.35	0.12
Cargo Equipment	0.8	0.43	0.34	<0.05	0.43	0.02
Harbor Craft	3.8	0.24	0.91	1.0	0.24	0.47
On-Port Trucks and Locomotives	0.2	0.50	0.10	0.03	0.50	0.02
Off-Port Trucks and Locomotives, plus Transport Refrigeration Units	44.7	1.00	44.7	5.6	1.00	5.60
Total	57.3		47.27	12.3		6.66

We then calculate the desired statistics using the totals – mass emissions of diesel PM are reduced by 79 percent, while exposure-adjusted emissions of diesel PM are reduced by 86 percent, correlating to an expected 86 percent reduction in health risk.